



Coach
Coeus

CELLULAR BIOLOGY

Review Session

Introduction

- **Cell Theory**
- developed due to invention of microscopes
- Cells are the fundamental building blocks of all living organisms.
- The cell is the smallest and most basic unit of life.
- Cells only come from pre-existing cells.



Atypical Cells



Giant Algae is atypical as it has larger than typical cells. Its cells are approximately 4 inches long while the average cell is less than a millimeter large.



The aseptate fungal hyphae (a threadlike structure in fungi) is an uninterrupted tube like structure with many nuclei spread around it.



Striated muscle fibers are larger than most animal cells at approximately 1 inch. They also have many nuclei surrounded by a membrane.

Multicellular vs. Unicellular



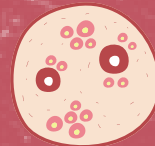
Complexity of Structure

- Multicellular organisms consist of multiple specialized cells organized into tissues, organs, and organ systems, each performing specific functions.
- Unicellular organisms are composed of a single cell that carries out all necessary functions for survival and reproduction.



Size and Scale

- Multicellular organisms tend to be larger in size and more visible to the naked eye due to the aggregation of numerous cells.
- Unicellular organisms are usually microscopic in size, as they are single-celled



Properties

- Adaptation in multicellular organisms often involves interactions between specialized cells and tissues--> Emergent properties
- Unicellular organisms adapt to their environment through mutation, gene transfer, and rapid reproduction, letting them evolve quickly

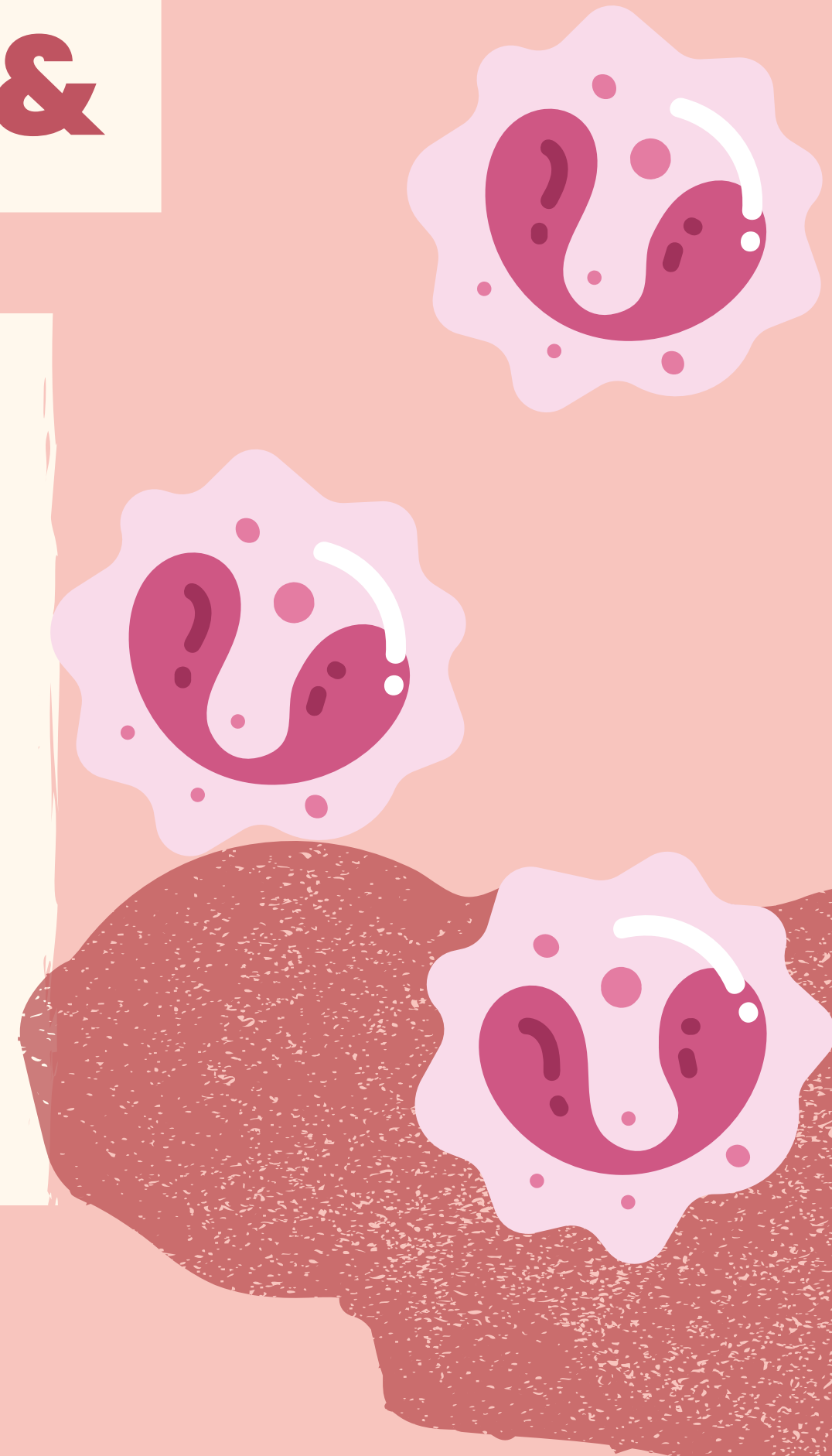
LIMITATIONS OF CELL SIZE

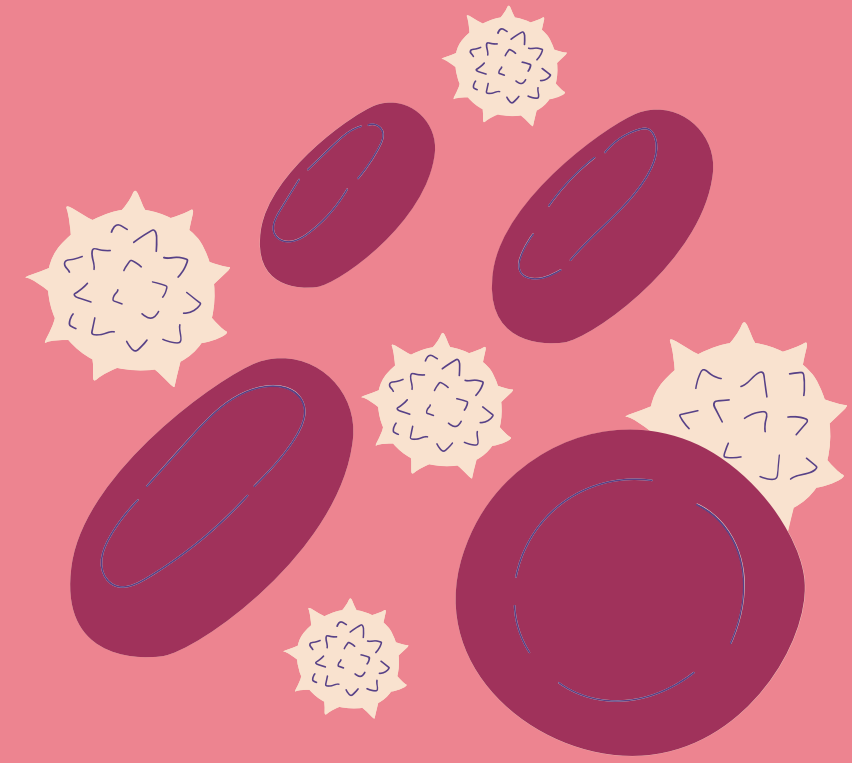
- Cells have to be small in order to maintain high surface area to volume ratio
 - The larger a cell is (mass/volume) , the energy it will need to exchange w/ environment
- Volume increases faster than surface area
 - If the cells volume becomes too high without an inc. SA the cell will die



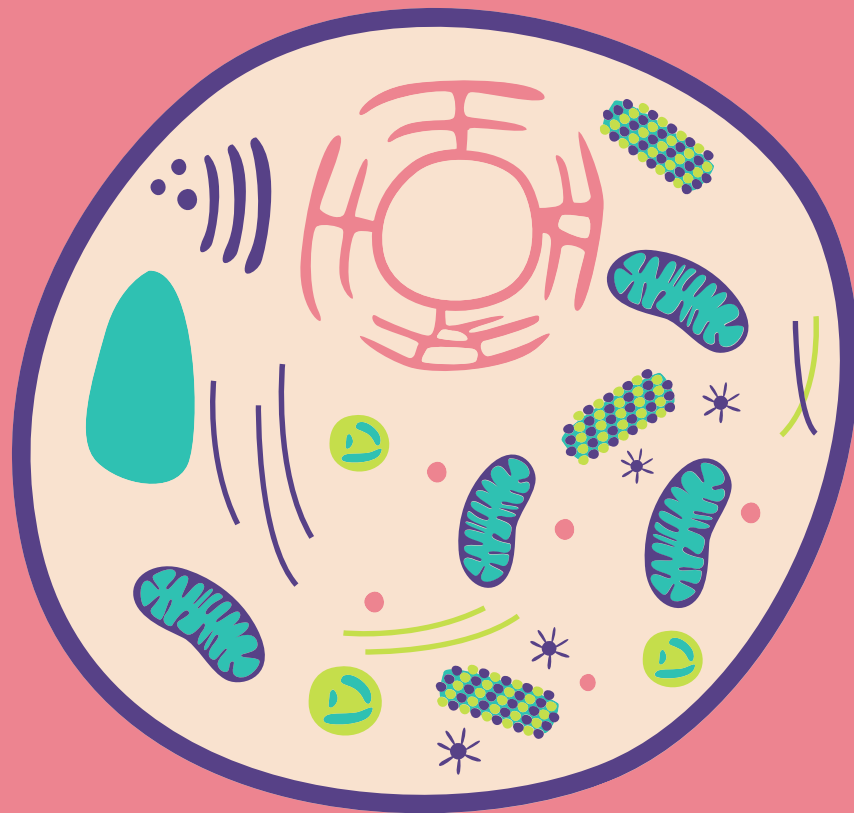
CELL DIFFERENTIATION & STEM CELLS

- Differentiation: the development of cells in different ways to carry out specific functions
 - Only genes pertaining to the cell function will be expressed even though it has same genome as every cells
- Stem Cell: the zygote & cells of early embryo
- Useful b/c can keep dividing to produce new cells for growth or replacement
- These are not fully differentiated --> useful for research (Stargardt & Leukemia)
- Sources of stem cells: adult tissue, umbilical cord blood, embryos



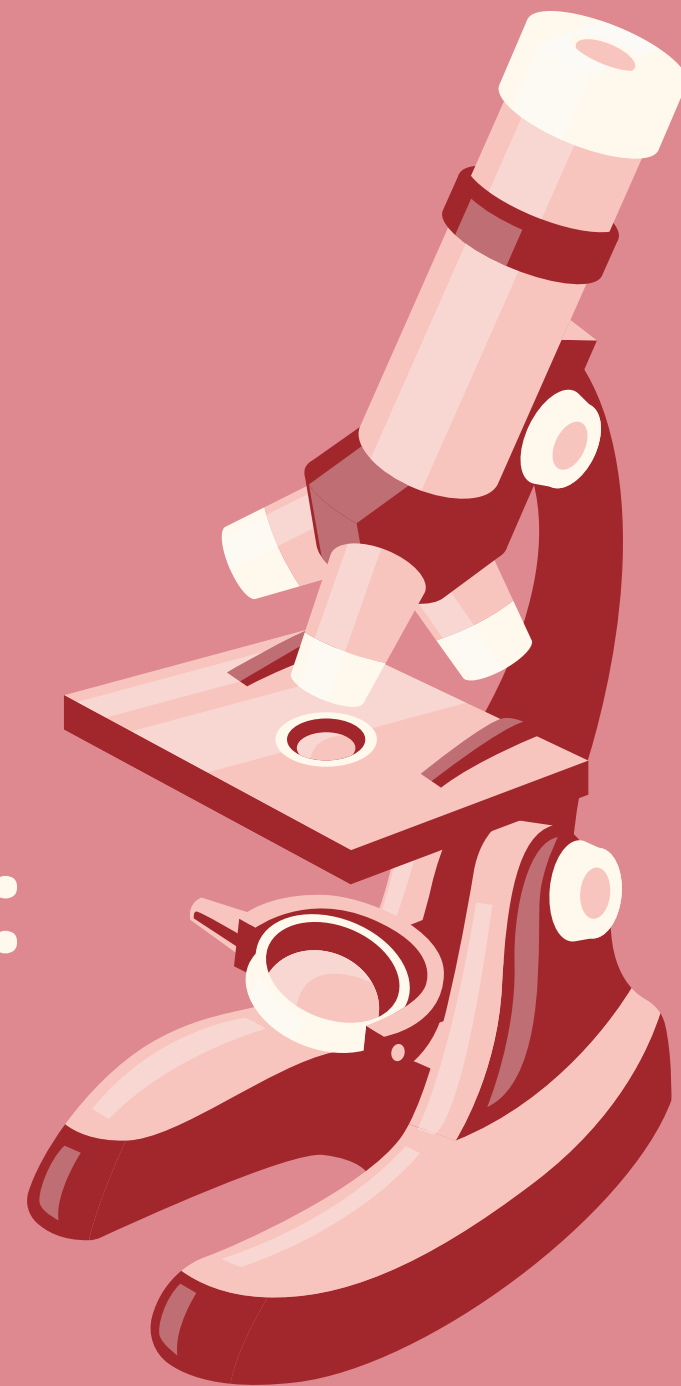


1.2 Ultrastructure of Cells



MICROSCOPES

- **Electron Microscopes:** reveals ultrastructure of cells, better than light microscope (limited magnification)
- **Scanning Electron Microscope (SEM):** detailed, magnified images... surface
- **Transmission Electron Microscope (TEM):** higher resolution than SEM ... inner



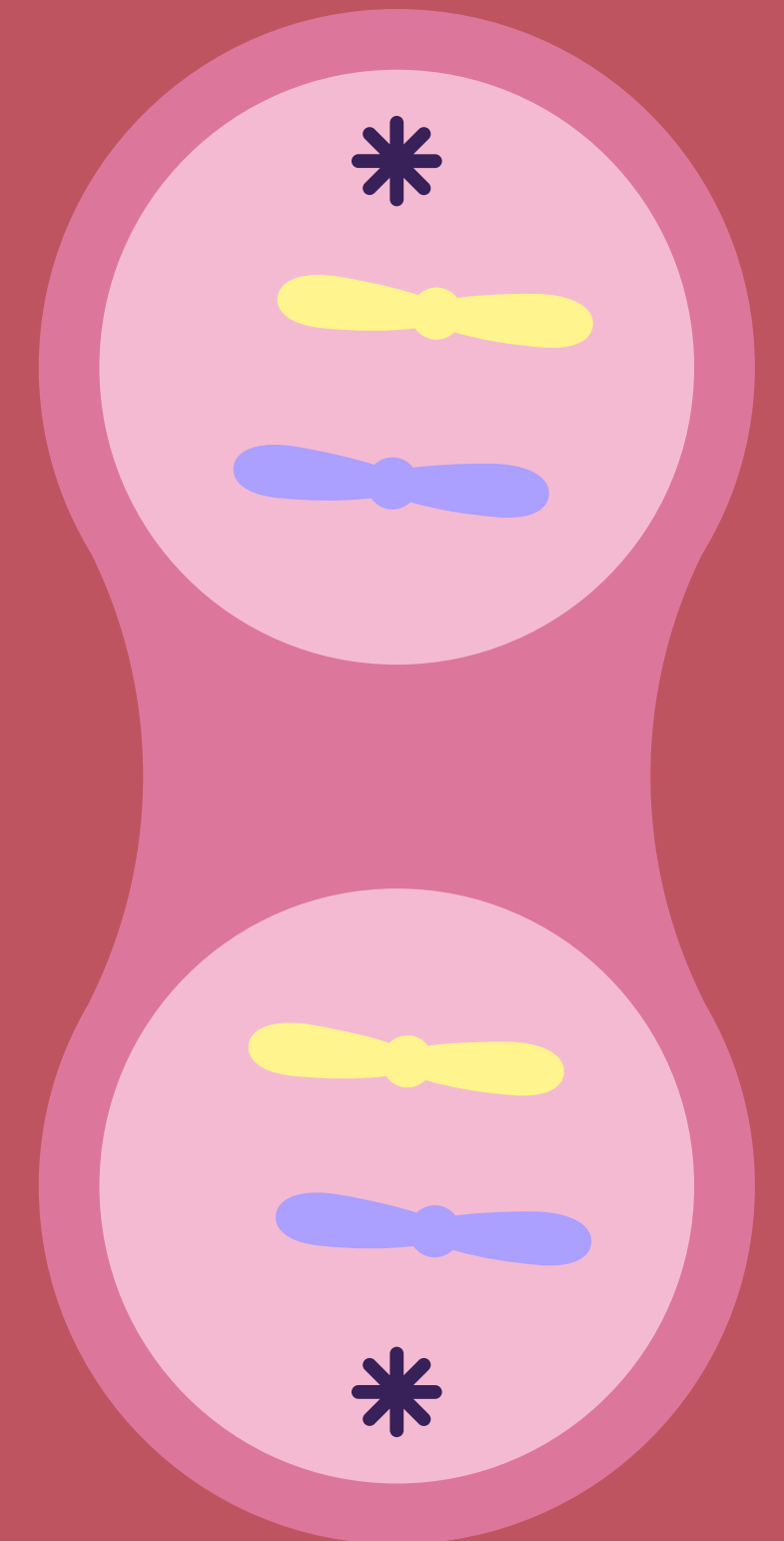
PROKARYOTIC CELLS

Cell Structure

- Prokaryotes: organisms whose cells lack a nucleus
- Archaea and bacteria
- DNA found in nucleoid & circular, cell membrane & cell wall w/ peptidoglycal
- 70S ribosomes

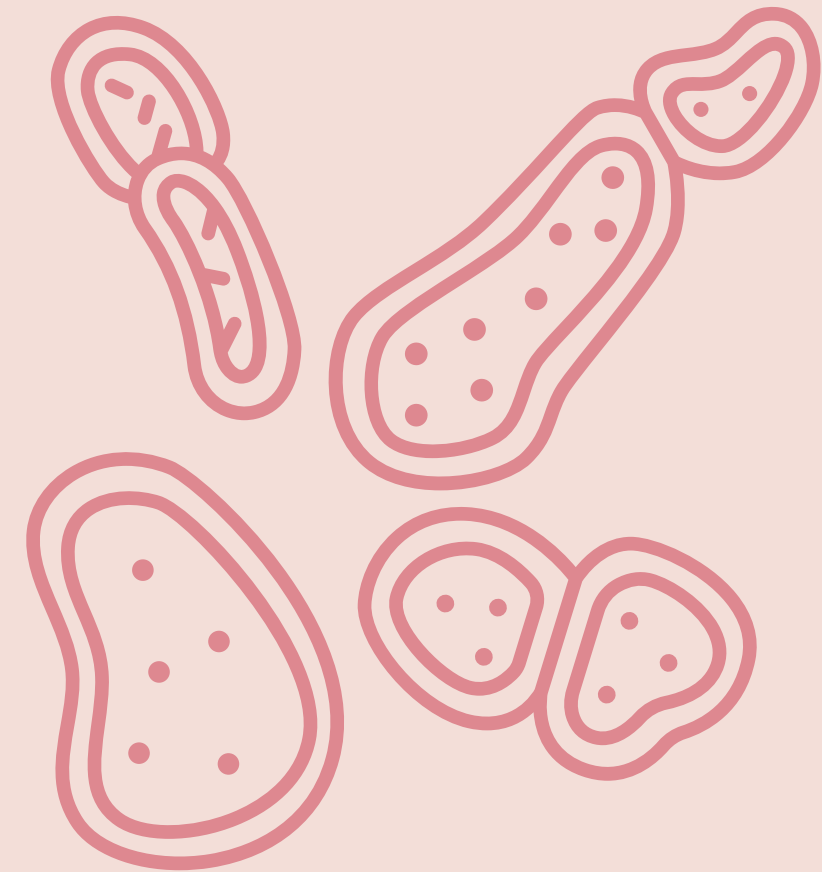
Cell Divsion

- Binary Fission: asexual reproduction



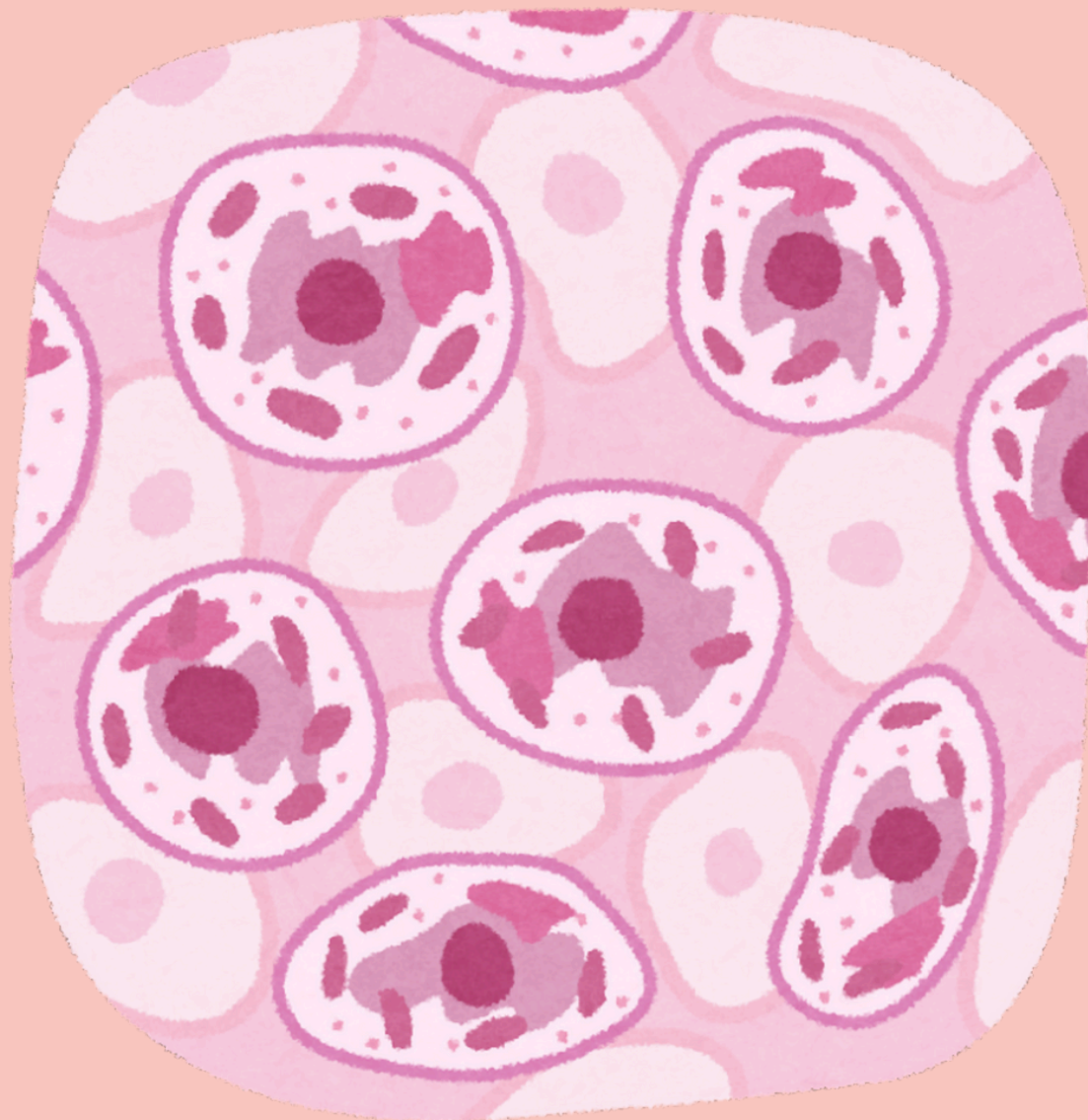
Eukaryotic Cells

- Eukaryotes contain a nucleus
- fungi, protists, animals, plants
- nucleus contains chromosomes
- compartmentalization ... has organelles w/ distinctive structure & function



ORGANELLES

only eukaryotes have organelles b/c of compartmentalization



01.

Universal:

- Plasma membrane
- Ribosomes
- Cilia & flagella

02.

Eukaryotic :

- Endoplasmic reticulum (smooth & rough)... transport lipids vs. proteins
- Golgi apparatus
- Mitochondria
- Peroxisome & lysosome
- centrosome
- Vacuole & vesicle

03.

Plant Only

- **Chloroplast:** site of photosynthesis , double membrane
- rigid cell wall

1.5 The Origin of Cells

ABIOTENESIS

STANLEY MILLER &
HAROLD UREY:

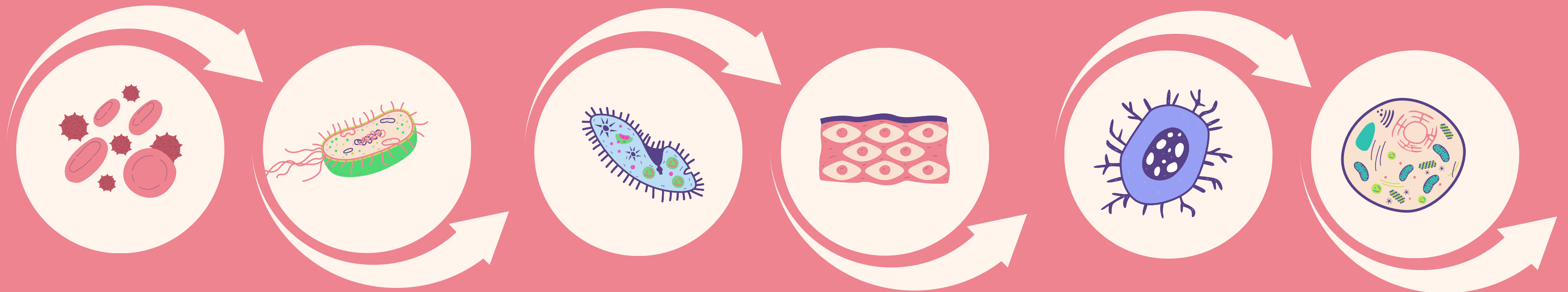
DEEP SEA
VENTS

THE THEORY THAT LIVING CELLS AROSE FROM NON-LIVING MATTER (1.5-U2: THE FIRST CELLS MUST HAVE ARISEN FROM NON-LIVING MATERIAL)

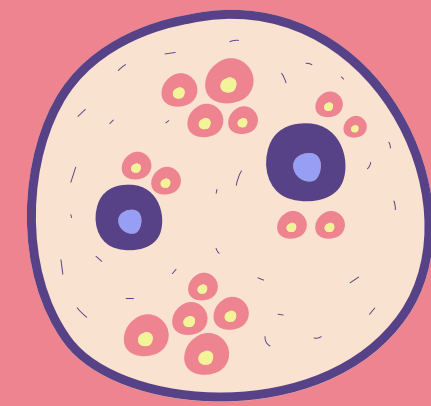
DEMONSTRATED THE PRIMORDIAL SOUP HYPOTHESIS
--> SHOWED THAT MIXTURES OF ORGANIC
COMPOUNDS NECESSARY FOR LIFE COULD'VE ARISEN
FROM SMALLER COMPOUNDS ON A PRIMATIVE EARTH

COULD BE SOURCE FOR INORGANIC CHEMICALS USED
AS A SOURCE OF ENERGY TO ASSEMBLE CARBON
COMPOUNDS POLYMERS

- **Spontaneous generation:** the idea that life arises from nonlife (WRONG!)
- **disproved by theory of biogenesis:** only living organisms can produce other living organisms -->
Louis Pasteur: biogenesis is true even for microorganisms



Endosymbiotic Theory



- **Endosymbiotic Theory:** Eukaryotic cells evolved from early prokaryotes
- large cell engulfs a smaller cell via endocytosis --> engulfed cell contributes to functionality of larger cell
- over time engulfed cell loses functionality and becomes supplemental organism
- Endosymbiotic organelles: mitochondria & chloroplasts (own circular DNA molecule, make own proteins via 70s ribosomes etc.)



Thank you!



